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ABSTRACT

The first of a three-part series on computer-assisted instruction (CAI), this report describes 11 exemplary programs across the country that involve the use of microcomputers for instruction in computer science, mathematics, and science at the elementary and secondary levels. At the head of each description are the name and address of the school (or consortium or school district) implementing the program and the name and title of a person to contact there for further information. The programs featured include a 5-year computer literacy plan, an inservice staff development scheme, a set of graphic data displays for teaching physics, a computerized math tutorial program entitled "Kids Helping Kids," various programs in computer science and word processing, computer-assisted vocational programs, computer-based adult education classes in business and data management, and a districtwide curriculum plan aimed at computer awareness in elementary school, computer literacy in junior high, and computer science in senior high. Also included is a description of the Minnesota Educational Computing Consortium, a statewide agency devoted to propagating instructional use of microcomputers and producing student-inspired courseware. Additional resources are listed for interested principals, including upcoming workshops and computer periodicals. (TE)

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Part I

Microcomputers for Classroom Instruction

"Class, switch on your computers," says the math teacher (or English, home ec, music, etc.) at a secondary urban (or suburban, rural, magnet, alternative) school. While the students actively participate in learning with their user-friendly, dialoging TRS-80s (or Apples, Ataris, Commodores, Franklins, or IBMs), their teacher walks around to give the individualized personal attention that only a human instructor can offer.

A scenario from Orwell's *1984*? No, an actuality in many American high schools right now.

This *Curriculum Report* is the first of three to showcase exemplary programs in high schools that use microcomputers for classroom instruction in all academic disciplines: math, science, English, business education, social studies, physical education, health, the fine and practical arts, foreign languages, and special education.

Revolution of the '80s

Computers have been used for administration and classroom management for many years, but the new low cost of personal micros as tools of classroom instruction is the revolutionary education news of the decade. Only the slow development of educationally sound courseware has deterred even greater use of computers in the schools.

Now, courseware (software disks plus teacher manuals, pre and post-tests, and student worksheets) are proliferating under bona fide field-testing and evaluation procedures. Even the financial crunches schools face do not keep many from "finding the way," once the will and commitment have been assured to fund hardware, courseware, and inservice training of teachers in computer use.

The ingenuity of boards of education, administrators, parents, teachers, and students in procuring funds is astonishing. Federal funding (while it lasts), state funding, local-district budgeting, private sector donations, PTA and individual parent contributions, teacher efforts, and students' own fund-raising projects have helped usher beleaguered schools into the most promising development of the century.

Initially, computer-assisted instruction was mostly drill-and-practice work, not too different from textbook and worksheet exercises. But now, tutorial dialogs, games, simulations, and other lessons that involve students to a greater extent are available. Color graphics, voice synthesizers, new technology in computer manufacture, and ingenious courseware programming signal an even greater possibility for excellence in academic achievement.

Exempli Gratia

LYONS TOWNSHIP HIGH SCHOOL, 100 South Brainard Ave., LaGrange, Ill. 60525. *Contacts:* John L. Bristol, superintendent; Estella Gahala, director of curriculum and instruction.

This large, suburban, comprehensive high school decided in 1980 to "go it alone" with *Computer Literacy—A Comprehensive Program,* a five-year plan to incorporate microcomputer classroom instruction into its entire curriculum. By 1982, the school was one of the first in the nation to have provided its 270 teachers and 3,800 students with short courses in computer literacy and awareness, as well as establishing elective, specialized credit courses in computer science (programming). Using local resources, the district funded a total of $390,000 for TRS-80s, courseware development, and teacher inservice.

By the fall of '82, Lyons had a network system of 236 TRS-80s with downloading capability in two 26-student-station laboratories at each of its campuses, and a computer science lab at one campus. During 1983-84, a computer-word processing lab, using *Scripsit* courseware, will open at each campus for business education and English composition. Teachers of all subjects now reserve time for their classes in the labs, much as they reserve audiovisual equipment.

"Now, courseware (software disks plus teacher manuals, pre and post-tests, and student worksheets) are proliferating under bona fide field-testing and evaluation procedures."

The computer science department offers six, one-semester computer programming courses in BASIC, FORTRAN, COBOL, and PASCAL, and a two-semester Computer Science AP (PASCAL) course. Students who take this course will take the first Advanced Placement Examination in Computer Science in May 1984.

Business education, math, and science departments all encourage students to take computer science classes such as *Electronic Microcomputer Technology*, a two-semester course offered by the industrial technology department.

"The ingenuity of boards of education, administrators, parents, teachers, and students in procuring funds is astonishing."

The first year of Lyons' comprehensive program was devoted to a series of inservice orientation meetings and four, two-hour computer literacy workshops for teachers. The purpose was to prepare the instructors to teach a workshop for all students the following year.

Because of the dearth of educationally sound courseware, in 1981 Lyons decided to encourage its own teachers, with the aid of professional computer programmers and a core of enthusiastic "master teachers," to write software related to their respective subject matters. Six-week-long Summer Software Development Workshops, for which volunteer teacher-authors who participated were paid, produced more than 100 computer-assisted programs in all subjects except driver education.

Science Research Associates (IBM) has since purchased, for $200,000, 51 of those programs to debug and convert for IBM micros. The sum is a tidy nest egg that will be used to implement the next two years of Lyons' five-year comprehensive curriculum program.

Curriculum and instruction director Estella Gahala says of the trial-and-error experience, "If we had to start over again, we'd probably do it differently." She advises others who are just starting: "Familiarity (with computers) breeds comfort, but I would eschew educators' inclination to jump on a bandwagon and rush to do the trivial with micros." She also cautions that not all teachers are receptive to the computer's invasion of their "territory." "Some are wildly enthusiastic, a few less so. We have been careful to enlist their voluntary participation and with few exceptions have succeeded."

And what about students? Youthful enthusiasm about computers, sometimes excessive on the part of video arcade fans and home computer hackers, has received wide media attention. But most teachers have found students to be not only serious, eager, fascinated, and adept users of micros for learning, but also sharing, creative, and *faster* learners than their teachers in a mutual enterprise. During three years of the Lyons project, Ganala said, "At most, only five students have ever told me, 'It's all a dumb waste of time.' "

Superintendent Bristol will be one of the presenters for the NASSP Institutes in St. Louis and Boston.

MINNESOTA EDUCATIONAL COMPUTING CONSORTIUM, 2520 Broadway Dr., St. Paul, Minn. 55113. *Contacts:* Don Rawitsch, director of user services; Nancy Kozen, research and development specialist.

Many schools that are establishing a computer-assisted curriculum may benefit from the help of a national, state, regional, or large-city district consortium. One outstanding example is the Minnesota Educational Computing Consortium (MECC), the best known, oldest, and most energetic proponent of instructional use of micros.

MECC was established in 1973 as a consortium of the University of Minnesota, the State University System, the Community College System, and the State Department of Education. Service staff was hired, and MECC signed a contract with Control Data for leased time-sharing of a mainframe computer. Terminals were installed in colleges and schools with telephone connections to the main computer. It was strictly a business deal and very expensive. Although the time-share network dwindled and finally closed in June 1983, MECC remained active.

The advent of microcomputers changed the role of MECC and spurred its rapid expansion. It was cheaper for schools to operate their own micros than to lease computer time, but giving up Control Data's PLATO programs required schools to increase the instructors' training and provide more software for the micros. In 1977 MECC began to produce courseware under an agreement with Apple manufacturers, and Minnesota schools were allowed special rates for buying Apple hardware.

In 1981, MECC allowed the Apple contract to lapse, hoping that by accepting competitive bids from other companies, it might make a better deal. After five months, however, the old Apple contract was reinstated—though not exclusively. MECC remains closely tied to Apple but has now also signed contracts with Atari, Commodore, Tandy (TPS-80), and IBM. MECC does not create totally new courseware for these new manufacturers, but converts its programs for use on the other machines.

Production and sales of computer software are a small part of MECC responsibilities. The staff is divided into three divisions:

- Management Information Services, which serves managers and school administrators
- Special Projects, which explores potential uses of computers, develops research projects, and evaluates commercial software
- Instructional Computing, which is directly linked to instruction through:
  - — User Services. MECC personnel visit schools, conduct workshops, train teachers in the use of computers and in teaching computer science
  - — Instructional Systems Development. Creates and tests courseware for school use
  - — Documentation Center. Sells disks and other courseware.

At the end of May 1983, the Minnesota legislature

appropriated $6.5 million for support of educational technology which will flow directly to the schools, with only 20 percent of its funding to MECC. The rest of MECC's budget must be earned. Demand for its courseware from educators in 10 countries and districts in 35 states has become so great that these "institutional memberships" pay a fixed annual fee for the right to duplicate and/or distribute MECC products and services at a discount outside Minnesota. This income enables MECC to grow as a non-profit organization.

MECC decides what to create on the basis of surveys of teachers in Minnesota. Demand is increasing for courseware that are simulations rather than drill-and-practice. Once a topic has been chosen, it takes MECC about a year to produce a courseware package. To produce 50 good ones in a year, Don Rawitsch estimates, costs about $1 million, including field testing and evaluation.

MECC does not hire expensive whiz kids to write programs. College and even high school students produce good results. Younger people tend to be more creative, Rawitsch claims, and the high school students have often come up with the best ideas.

Until now MECC has not attempted to build any electronic protection against copying of its disks, partly on the assumption that determined pirates can always find ways around protection schemes. But as its out-of-state sales (and need to generate income to survive) have grown, copying has become a greater problem and MECC will include protective devices in this year's productions. It has improved its marketing services by adding a lifetime guarantee on each disk, a backup disk for each product, a preview policy (pay in advance; full refund if not satisfied), and a customer-help telephone line.

MECC offers more than 75 courseware products, each with a set of 5-10 programs. An additional 100 programs have been developed for fall 1983, most of them in the areas of computer science, math, biology, social studies, and language arts.

BROKEN ARROW SENIOR HIGH SCHOOL, 808 East College St., Broken Arrow, Okla. 74012. *Contact:* GeorgeAnn M. Gusé, coordinator of computer education. BROKEN ARROW JUNIOR HIGH SCHOOL, 1901 East Albany, Broken Arrow, Okla. 74012. *Contact:* Kara Gae Wilson, principal.

As the fastest growing school district in Oklahoma, Broken Arrow's one senior high school, two intermediate highs, three middle schools, and nine elementary schools, have made the most of their computer dollars. In the fall of 1980 the senior high began a semester programming lab with five TRS-80 micros and one printer. Three semester courses have trained more than 500 students in *General Programming, Math/Sciences Programming,* and *Advanced Math/Sciences Programming* (prerequisite is three years of math.) The journalism class has also used the computer for the past two years.

Project TOUCH (Total Utilization of Computer Hardware) is a districtwide staff development program started in the spring of 1983 to enable every teacher to become acquainted with computer capabilities. The aim is a comprehensive K-12 computer-assisted curriculum by 1984-85. By fall of 1983 all district schools were equipped with at least six computers and a printer. A core of trained teachers are instructing workshops for all other staff.

The K-12 curriculum will focus on computer awareness in the elementary schools, computer literacy in the middle schools, and computer science at the high schools. The core of trained teachers are also evaluating courseware for every academic level.

CHELMSFORD HIGH SCHOOL, 200 Richardson Rd., Chelmsford, Mass. 01863. *Contacts:* Bruce Ford, physics teacher; Richard Olson, computer science teacher.

Chelmsford schools' 59 microcomputers are used for computer awareness and computer science courses, but Bruce Ford and Richard Olson hope the high school will soon extend instructional use of micros to other subjects. Ford, as science subject-matter specialist, and Olson as programmer, have created two outstanding micro-based instrumentation packages that are changing the face of science lab experiments. Programmed for the TRS-80, these programs are now being translated for Apple.

"Pixels and Pendulums" is a six-lesson instructional unit that teaches about harmonic motion using a rotational potentiometer and a serial analog-to-digital converter. Marketed by Cambridge Development Laboratory, "Pixels" has a variety of graphic data displays. Unlike any other such package, it uses on-screen tutorials to guide students through their investigations. Designed for physics courses, the program deals with a classic physics experiment.

The two teachers' newest instrumentation package, "Temperature Probe," asks students to use a thermometer to observe and monitor temperature changes for lab experiments in biology and other physical sciences.

"Only the slow development of educationally sound courseware has deterred even greater use of computers in the schools."

EATON MIDDLE SCHOOL, 225 Juniper St., Eaton, Colo. 80615. *Contact:* Jon A. Campbell, principal.

KIDS HELPING KIDS, an unusual math project that uses micros for instruction, is making the kids and their parents and grandparents beam with pride.

In January 1982, KIDS HELPING KIDS was developed by Quentin Goodwin, Eaton Middle School computer teacher, with Title IVC and Title I grants, some local district money, and BOCES funding. The project involves 40-50 accelerated math students and 50-60 Title I students annually. The accelerated students work with the Title I students in a one-to-one relationship in the computer lab, reinforcing the latter's basic math computation skills. Using

a 14-microcomputer lab with eight disk drives, the accelerated KIDS create custom-made programs — games, quiz shows — specifically designed for their respective Title I partners. The pairs of KIDS meet twice weekly during the school day, under the supervision of math/science and computer teachers, in addition to attending their regular math classes.

The goals of KIDS are to develop problem solving and critical thinking skills associated with math for the accelerated and to acquire and develop fundamental math and computer skills for the Title I KIDS. Parents and grandparents attend evening meetings with their KIDS to watch them demonstrate how they help each other.

NEW ROCHELLE HIGH SCHOOL, 265 Clove Rd., New Rochelle, N.Y. 10801. *Contact:* James R. Gaddy, principal.

New Rochelle High, the only public high school in an "urbanized suburban city" of 70,000, has a student body of 2,100. Microcomputers are used for computer science courses, as a teacher aid for drill and practice, and as a tool for data analysis and problem solving. The math department offers four computer science courses: *Introduction to Computers (BASIC), Computer Science I (BASIC), Computer Science II (FORTRAN, ASSEMBLER, PASCAL),* and *Computer Science AP.* This year 400 students are enrolled in those courses.

Last year, 25 faculty members, representing each academic department, attended an inservice workshop in instructional uses of micros. The workshop, developed with the help of the School of Education at Fordham University, was planned in anticipation of incorporating computer technology in all instructional areas for 1983-84.

The school has three computer labs, each equipped with 11 TRS-80 Model III micros, two TRS-80s with double disk drives, one Network II controller, four Apple II+ micros and single disk drives, one TRS-80 Model I micro, and two printers.

ROGERS HIGH SCHOOL, 1114 South 5th, Rogers, Ariz. 72756. *Contacts:* W. E. King, principal; Fran Williams, teacher.

For five years, Rogers High School has been preparing students for the high-tech information revolution. This year seven semester computer science courses are offered. Other computer-assisted courses are *Word Processing, Accounting,* and *Advanced Computer Science.*

The Computer Room is the most cost-effective area of the campus: high school students use it continuously from 8 a.m. to 3:30 p.m., and adult education classes use it from 4:00 to 5:30 p.m.

Initial funding for hardware and courseware came from the local Pioneer Club and Chamber of Commerce Education Committee. A local dealer lent a TRS-80 to the school; TRW Wendt-Sonis donated another micro in June 1980; local school funds purchased another the following month. An Electronic Data Processing Advisory Committee (EDPAC) Contribution Campaign in December 1980 funded six more TRS-80s, a line printer, and a network system. The following December, another EDPAC campaign enabled the school to purchase another TRS-80 with software, and in April 1983, purchase of a daisy-wheel printer. By 1983-84, school funds had purchased Apple micros for science and math classrooms, and the faculty were planning a semester course in *Keyboarding.*

WOOD RIVER JUNIOR HIGH SCHOOL, P.O. Box 1088, Hailey, Idaho 83333. *Contact:* Dennis F. Dempsey, principal.

Dennis Dempsey brought four years of computer experience to Hailey when he became principal in 1981. He wrote a Title IV grant proposal and received three microcomputers for Wood River Junior High, purchased another for his office from school funds, and another with funds raised by a student magazine drive. He then presented a plan to implement computer-assisted instruction districtwide.

The school board approved the package: hardware, software, and inservice for staff; $20,000 for equipment; and a computer programming teacher for the junior and senior high schools. A K-12 curriculum guide was created, as was a district software evaluation committee. Apples, TRS-80s, Commodores, and Franklins provide the hardware.

The junior high has eight micros networked on a Corvus system, and a robotic arm purchased with funds raised by students. Courseware and computers are used in the library and for teaching math, science, English, industrial arts, art, social studies, home ec, and health. Word processing courseware includes Bank Street Writer, Super Text, Apple Writer, and Word Handler for 9th-grade English composition.

At Wood River Junior High, Dempsey teaches the district inservice courses as well as graduate credit courses at night through Idaho State Univ. State president of Computer Education of Idaho and Blaine County Educational Computer Director, Dempsey will be one of the presenters at the NASSP Institute at Keystone, Colo. Lodge in January.

"Initially, computer-assisted instruction was mostly drill-and-practice work, not too different from textbook and work-sheet exercises. But now, tutorial dialogs, games, simulations, and other lessons that involve students to a greater extent are available."

MANCHESTER TOWNSHIP HIGH SCHOOL, 16 Colonial Dr., Lakehurst, N.J. 08733. *Contacts:* Richard F. Fosko, principal; Monica McAlister, math teacher.

Thanks to three years' hard work, all New Jersey high schools (and others interested) can now offer the *Computer Assisted Vocational Math* course that three teachers developed. They wrote the courseware curriculum of 32 lessons with state vocational-tech grants, used them at their school, taught workshops for other districts, had their program field-tested throughout the state, and received State Department of Education recognition for an exemplary program.

Computer Assisted Vocational Math is a 440-page volume of computer program lists in BASIC, tests, and work sheets, designed for TRS-80, Model I, Level II, 16K. The curriculum's goal is to increase basic math skills for students attending shared-time vocational-technical schools for the automotive trades, beauty culture, building trades, climate control, electric trades, medical/dental technology, and recreational vehicles. Math applications in each of those seven areas are incorporated into the curriculum.

The book, Catalog #MA-1028, is available for $25 from the Rutgers University Curriculum Laboratory, Building 4103, Kilmer Campus, New Brunswick, N.J. 08903. It is also available on a set of five micro disks.

Vocational-technical students attend Manchester, a comprehensive high school, for four hours in the morning and their respective vocational schools in the afternoons. Three classes in *Computer Assisted Vocational Math*, which fulfill all school math graduation requirements, meet four times a week in a regular math classroom, and a fifth morning in the math lab next door, which has 14 microcomputers. The lab is used afternoons by other students in regular math courses.

The Manchester teachers have developed another curriculum, *Computer Assisted Vocational English* in 24 lessons. Field-tested statewide during 1982-83, it has just been published by the Curriculum Laboratory at Rutgers, and is available for $9.

TYRONE AREA HIGH SCHOOL, Clay Ave. Extension, Tyrone, Pa. 16686. *Contact:* Neil R. Smith, principal.

This school's cooperative business/administration data management program is a long-term evening adult education curriculum. Designed for post-secondary students, it offers computerized courses in administrative accounting, communications and word processing, computer mathematics, business dynamics, fundamentals of taxes, cost accounting, economics of work, and special word processing. After earning 30 hours of credit at Tyrone High, students may continue the program for an additional 36 hours to receive an associate degree in microcomputer science at nearby Mount Aloysius Junior College.

As a result of the adult program at the high school, the computer lab with 17 Commodores and a system of disk drives and printers is accessible to high school students during the day. All 8th-graders are offered a computer literacy course; 160 students are taking various types of computer-assisted math courses; and another 80 students have instructional use of computers in their agriculture, drafting, business education, and distributive education classes.

MESA COUNTY VALLEY SCHOOL DISTRICT NO. 51, 2115 Grand Ave., Grand Junction, Colo. 81501. *Contact:* Tedd Brumbaugh, director of resources, research, and development.

This district serves a partly urban and partly rural county community of 88,000 with a K-12 enrollment of 16,000, 9,000 of whom are bused to school. Besides an alternative senior high school, whose students have half-day, on-the-job experience, the district has four senior high schools (10-12) of 1,000 students each, six junior highs (7-9) of 500 students each, and 21 elementary schools.

Capital reserves have provided 10 microcomputers at each senior high, 3 at each junior high, and 1 at each elementary school. The local Lions Club also donated 18 computers to the junior and senior highs.

The districtwide computer science curriculum for grades 5-12 provides computer awareness instruction in the elementary schools, computer literacy in the junior highs, and computer science in the senior highs. Teachers at all levels have received Colorado Department of Education Recertification credit for taking four, two-hour after-school courses at the high schools in *Introduction to Microcomputers* and *Understanding Computers and Software Materials*.

Secondary school teachers have received three semester hours' credit for summer courses in *Basic Programming in the Classroom* and *Programming in Pascal*, offered at Grand Junction High School.

Instructional use of microcomputers in the senior high schools has expanded this year to include business education and mathematics curricula. Courseware is purchased from MECC and from the Houston (Tex.) Independent School District. Houston's exemplary program in computer-assisted instruction for all subject matters will be described in Part II of this NASSP *Curriculum Report* series.

Resources for Administrators

The *Exempli Gratia* in this report offer suggestions for schools that are just starting to use computers for instruction. Each contact mentioned has agreed to furnish principals with further information. Also, NASSP is offering the following Institutes on microcomputer applications to instruction during 1983-84:

- The Marriott Downtown, St. Louis, Mo., Nov. 20-22
- Keystone, Colo., Lodge, Jan. 22-25
- Gainesville, Fla., Hilton, Feb. 23-25
- The Adolphus, Dallas, Tex., Feb. 26-28
- Cathedral Hill, San Francisco, Calif., March 15-17
- Portland, Maine, Sheraton Inn, April 5-7
- Boston, Mass., Copley Plaza, April 26-28.

For enrollment information, contact the NASSP Inservice Office, 1904 Association Dr., Reston, Va. 22091; (703) 860-0200 or 8430.

Another valuable resource for administrators is the book, *Computers in the Classroom*, edited by Henry S. Kepner,

Jr., published in 1982, by the National Education Association, 1201 16th St. NW, Washington, D.C., 20036. (Stock #1825-7-00, $7.95 prepaid.) Nine articles address the computer in the curriculum.

Still another resource is the September 1982 issue of the *NASSP Bulletin,* featuring "Computers in Education," a section of 16 articles. (Single copy, $6.)

Computer magazines, journals, and newsletters abound. Magazines with particularly useful articles on instructional uses of computers and reviews of courseware are:

- *SchoolTech News,* published by the Education News Service, 926 J St., Suite 212, Sacramento, Calif. 95814. Six issues per year. Introductory subscription offer: $16.50 per year until Dec. 15, 1983 when the regular price of $33 becomes effective. All NASSP members receive this newsletter as part of membership services.
- *The Computing Teacher,* published by the Dept. of Computer and Information Science, Univ. of Oregon, Eugene 97403. Nine-issue subscription, $16.50.
- *Electronic Learning,* published by Scholastic Inc., 902 Sylvan Ave., Box 2001, Englewood Cliffs, N.J. 07632. Eight-issue subscription, $15.
- *Classroom Computer News,* 341 Mt. Auburn St., Watertown, Mass. 02172. Eight-issue subscription, $19.95. This magazine also publishes an annual directory of hardware, software, information sources, computer languages, computer organizations, and local and regional resources. The *CCN 1984 Directory of Educational Resources* is available for $19.95.

Kudos

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